REMARKS

In the Office Action, the examiner objected to the specification because of the informalities, where the word "sixteenth" on page 4, line 6 should be "eighteenth". Accordingly, the applicant has amended the specification to correct the informalities. In this opportunity, the applicant has amended the specification to correct minor wording errors and to more clearly describe the features of the present invention. This is to verify that no new matter has been introduced by this amendment.

The examiner rejected Claims 1-4, 6-15 and 17-18 under 35 U.S.C. 103(a) as being unpatentable over Mori (U.S. Patent No. 4,325,664 in view of Chandrasekar (U.S. Patent No. 6,036,413) and the Machinery's Handbook. Accordingly, the applicant has amended the claims to more clearly differentiate the present invention from the technologies disclosed by the cited references. More specifically, the applicant has added the limitations that "the cutting tool is a face milling cutter having a cutting diameter of 80-160 mm" and that "an inner shape of the receiving hole is substantially identical to an outer shape of the protrusion" to Claim 1". The applicant has added the limitations similar to that of Claim 1 noted above to Claims 9 and 14.

The limitation of "the cutting tool is a face milling cutter having a cutting diameter of 80-160 mm" is originally defined in Claim 8 and is supported by the descriptions at page 6, lines 3-7, and page 8, lines 9-13. This limitation is further supported by

the description at page 16, lines 6-16 which indicates the preferable range of cutting diameter of about 50-160 mm. The limitation of "an inner shape of the receiving hole is substantially identical to an outer shape of the protrusion" is supported by the description in the specification, for example, at page 13, lines 9-32 and the drawings, for example, Figs. 1A-1B which clearly show the cylindrical shape of the protrusions 13 and Figs. 2A-2B which clearly show the circular shape of the receiving hole 23 where the protrusions 13 snugly fit therein.

As a consequence, as defined in Claim 1 as amended, the essential features of the present invention reside in the fact that (1) the cutting tool assembly has a weight of not larger than 3 kg and a spindle nose size of No.30, (2) the cutting tool is a face milling cutter having a cutting diameter of 80-160 mm, and (3) the relative-rotation preventing mechanism has a receiving hole and a protrusion to engage with one another where an inner shape and size of said receiving hole is substantially identical to an outer shape and size of the protrusion. Because of these features, it is possible to reduce the weight of the cutting tool assembly without reducing the rigidity for permitting a cutting tool of a large cutting diameter 80-160 mm in a small-sized machine tool with a spindle nose having a size of No. 30. These essential features of the present invention are not shown or suggested by the cited references as discussed below.

The cited Mori reference discloses a cutting tool in which the cutter can be easily detached from the arbor head and yet is prevented from slipping out of the fingers of the worker. The cutting tool in the cited Mori reference is to solve the disadvantage of the conventional cutting tools which arises when removing the cutter from a vertical type milling machine. Because the bolt has to be unscrewed with one hand of the worker with the cutter supported with the other hand, the cutter 3 may slip out of the fingers of the worker.

To solve the problem noted above, the cutting tool disclosed by the cited Mori reference includes, among others, a collar 14 fitted on the shank of the bolt 12. The periphery of the collar 14 is provided with two enlarged portions (outward flanges) 15 which are symmetrical about the axis of the collar 14. A cutter 21 of the cutting tool is provided with a ring 24 which serves as an inward flange. Two pins 27 are provided on the end surface of the arbor head which faces the cutter 21 and two arcuate grooves 29 are provided on the surface of the cutter 21 so that the pins 27 are allowed to fit in the arcuate grooves 29.

In order to mount the cutter 21 on the arbor head 10, the collar 14 passes through the ring 14 and each of the pins 27 fits in the arcuate groove 29 in such a manner that the pin 27 is positioned at one end 30 of the arcuate groove 29. Then the cutter 21 is turned until each of the pins 27 comes in contact with the other end 31 of the arcuate groove 29. As a result, the two

enlarged portions 15 engages with the ring 14 so that the cutter 21 will not drop from the arbor head 10.

The cited Mori reference, however, does not show or suggest the specific structure of the cutting tool assembly of the present invention to achieve the light weight, large cutting blade, and high rigidity. As noted by the features (1) and (2) above, the cutting tool assembly of the present invention has a weight of not larger than 3 kg and a spindle nose size of No.30, and the cutting tool is a face milling cutter having a cutting diameter of 80-160 mm. Such a specific numerical limitation is not shown or suggested by the cited Mori reference. As is known in the art, in the conventional technology, the cutting tool assembly of less than 3 kg and the spindle nose size of No. 30, the maximum available size of the face milling cutter is 80 mm in diameter.

In contrast, the cutting tool assembly of the present invention achieves the cutting diameter of 80-160 mm because of the specific structure such as (but not limited to) in the relative-rotation preventing mechanism. By this structure, it is possible to reduce the weight of the cutting tool assembly without reducing the rigidity. The cited Mori reference teaches away the essential features of the present invention, because, for example, the cutting tool disclosed by the cited Mori reference increases the weigh by adding the collar 14 fitted on the shank of the bolt 12 and the periphery of the collar 14 is provided with two enlarged portions 15 which serve as the outward flanges. The weight of the

cutting tool of Mori is further increased because of the ring 24 which serves as the inward flange to engage with the enlarged portions 15.

Furthermore, the cutting tool of the cited Mori reference includes a pair of arcuate grooves 29 to receive the pair of pins 27 which allow the rotation of the cutter about 45 degrees. Because the arcuate grooves 29 are relatively long formed by removing the material on the cutter, the rigidity of the cutting tool is impaired. To maintain the rigidity, the volume of the material of the cutting tool has to be increase. This also teaches away the present invention in which the weight of the cutting tool assembly is reduced without reducing the rigidity. Therefore, the specific features (1) and (2) of the present invention are not shown or suggested by the cited Mori reference. Rather, the cited Mori reference teaches away the specific features of the present invention as discussed above.

Further, with respect to the feature (3) noted above, the cutting tool assembly of the present invention includes the relative-rotation preventing mechanism which has a receiving hole and a protrusion to engage with one another where an inner shape and size of said receiving hole is substantially identical to an outer shape and size of the protrusion. This feature is shown in Figs. 1A-1B which show the cylindrical shape of the protrusions 13 and Figs. 2A-2B which show the circular shape of the receiving hole 23 where the protrusions 13 snugly fit therein. In the cutting

tool of the cited Mori reference, however, it is apparent that the shape and size of the arcuate groove 29 is completely different from the shape and size of the pin 27 to allow the sliding movement of the pin 27 along the arcuate groove 29 when the cutter is rotated. Therefore, the specific feature (3) of the present invention is not shown or suggested by the cited Mori reference.

The cited Chandrasekar reference discloses a machine tool assembly capable of high rotary speeds for cutting while providing a stiff and stable system. The machine tool assembly includes a spindle unit with hydrodynamic bearings which allow for highly accurate and precise machining operations with high spindle rotary speed. In the office action, the examiner stated that Chandrasekar teaches the idea of reducing the spindle size 12, and thereby weight, while still providing a stiff and stable system for highly accurate machining for the purpose of taking loads similar to those borne by large diameter spindles. The examiner further stated that therefore it would have been obvious to one having ordinary skill in the art to have modified the arbor of Mori with a spindle of reduced size as taught by Chandrasekar in order to use a cutting tool with normally used on larger spindles.

The applicant respectfully disagrees with the examiner regarding the interpretation of the cited Chandrasekar reference. Anyone in the industry wants to reduce the weight of any tool without significantly impairing its performance. To reject the invention under 35 U.S.C. 103(a), a cited reference must show not

only the motivation to combine, but also the way of solving the problem is similar or identical. The solution of the problem disclosed by the cited Chandrasekar reference is to use the hydrodynamic bearings rather than the rotary bearings. This solution has nothing to do with the solution of the present invention. As noted above, the solution of the present invention is a specific structure of the cutting tool assembly, such as the relative-rotation preventing mechanism including the protrusions and the receiving holes. The cutting tool assembly of the present invention is a small tool of 3 kg or less and has no relationship with the hydrodynamic bearings used in a large scale machining system. Since the cited Chandrasekar reference merely shows the general desire or motivation for reducing the weight and the solution of which is too remote from that of the present invention, the rejection under 35 U.S.C. 103(a) based on the cited Chandrasekar reference is inappropriate.

As discussed above, since none of the essential features of the present invention are shown or suggested by the cited references, the present invention defined in the claims is not obvious over the cited references taken singly or in combination. Thus, the applicant believes that the rejection under 35 U.S.C. 103(a) is no longer applicable to the present invention.

The applicant has added the limitations to Claims 8 and 18 regarding the locations of the three receiving holes and the three protrusions. These features are supported by Figs 1B and 2A and

the corresponding descriptions in the specification which show the locations of the three receiving holes and the three protrusions.

In view of the foregoing, the applicant believes that Claims 1-18 are in condition for allowance, and accordingly, the applicant respectfully requests that the present application be allowed and passed to issue.

Respectfully submitted,

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